

REMARKS

Claims 1-17 are currently pending in the present application. Claims 1, 2 and 17 are independent claims respectively drawn to a food grade wax composition, a process for preparing a wax composition from crude sugar cane wax, and a comestible including the food grade wax composition of claim 1. Claims 3 to 16 depend from claim 2.

The rejection under 35 U.S.C. §103(a) of claims 2-17 in Paper No. 3 still stands. Specifically, claim 17 is rejected under 35 U.S.C. §103(a) as being unpatentable over the Synosky et al. reference in view of the Grimm, III patent; claims 2-5, 8, 9 and 12-14 are rejected under 35 U.S.C. §103(a) as being unpatentable over the Fujisawa et al. reference in view of the Arai et al. reference, the Whyte et al. patent and the Rieger et al. patent; claims 6 and 7 are rejected under 35 U.S.C. §103(a) as being unpatentable over the Fujisawa et al. reference in view of the Arai et al. reference, the Whyte et al. patent and the Rieger et al. patent as applied to claim 2, and further in view of the Shimizu et al. reference; claims 10 and 11 are rejected under 35 U.S.C. §103(a) as being unpatentable over the Fujisawa et al. reference in view of the Arai et al. reference, the Whyte et al. patent and the Rieger et al. patent as applied to claim 2, and further in view of the Haines et al. patent; claim 15 is rejected under 35 U.S.C. §103(a) as being unpatentable over the Fujisawa et al. reference in view of the Arai et al. reference, the Whyte et al. patent and the Rieger et al. patent as applied to claim 2, and further in view of the Noda Wax reference; and claim 16 is rejected under 35 U.S.C. §103(a) as being unpatentable over the Fujisawa et al. reference in view of the Arai et al. reference, the Whyte et al. patent and the Rieger et al. patent as applied to claim 2, and further in view of the McLoud patent and the Wilder patent.

In Paper No. 6, claim 1 is rejected under 35 U.S.C. §103(a) as being unpatentable over Synosky et al., Miguel-Colombel et al. (US 5882657) and Lake (US 3931258).

Claim 1 has been canceled in connection with the 35 U.S.C. §103(a) rejection of that claim. The claim has been replaced by new claim 18 which is a product by process claim. No new matter within the meaning of 35 U.S.C. §132 is added by this amendment there being disclosure at page 3, lines 24 to 27 of the description that one aspect of the invention is the product of the process according to the invention.

Claim 2 has been amended to make it clear that the process produces a food grade wax composition and that in step (iii) it is the upper phase from the previous step that is used in the following steps of the process. Again, no new matter within the meaning of 35 U.S.C. §132 is added by this amendment. It is stated at page 3, lines 2-4 that an object of the invention is to provide a process for preparing a food grade wax composition that is suitable for use in comestibles, and at page 5, lines 11 and 12 that it is the upper phase formed in step (ii) of the process that contains the wax of interest.

Claim 17 has been amended for correct reference to the new claim that replaces canceled claim 1.

1. REJECTION OF CLAIMS 2-16 UNDER 35 U.S.C. §103(a)

As noted above, the rejection under 35 U.S.C. §103(a) of claims including claims 2-16 in Paper No. 3 still stands. Specifically, claims 2-5, 8, 9 and 12-16 are rejected under 35 U.S.C. §103(a) as being unpatentable over the Fujisawa et al. reference (JP 07011284A) in view of the Arai et al. reference (JP 06200289A), the Whyte et al. patent (U.S. Patent No. 2,683,092) and

the Rieger et al. patent (U.S. Patent No. 4,064,149) for the reasons set forth in Paper No. 3. Claims 6 and 7 are rejected under 35 U.S.C. §103(a) as being unpatentable over the Fujisawa et al. reference in view of the Arai et al. reference, the Whyte et al. patent and the Rieger et al. patent as applied to claim 2, and further in view of the Schimizu et al. reference. Claims 10 and 11 are rejected under 35 U.S.C. §103(a) as being unpatentable over the Fujisawa et al. reference in view of the Arai et al. reference, the Whyte et al. patent and the Rieger et al. patent as applied to claim 2, and further in view of the Haines et al. patent (U.S. Patent No. 2,908,702) for the reasons set forth in Paper No. 3. Claim 15 is rejected under 35 U.S.C. §103(a) as being unpatentable over the Fujisawa et al. reference in view of the Arai et al. reference, the Whyte et al. patent and the Rieger et al. patent as applied to claim 2, and further in view of the Noda Wax reference (JP 02115299A) for the reasons set forth in Paper No. 3. Lastly, claim 16 is rejected under 35 U.S.C. §103(a) as being unpatentable over the Fujisawa et al. reference in view of the Arai et al. reference, the Whyte et al. patent and the Rieger et al. patent as applied to claim 2, and further in view of the McCloud patent (U.S. Patent No. 2,456,641) and the Wilder patent (U.S. Patent No. 2,456,661) for the reasons set forth in Paper No. 3.

RESPONSE

Applicant traverses the rejection and respectfully requests reconsideration and withdrawal thereof.

Applicant again respectfully submits that the references of record, do not teach or suggest applicant's inventive subject matter as a whole, as recited in the claims. Further, there is no teaching or suggestion in these references which would lead the

ordinary skilled artisan to modify the references to derive the subject matter as defined in the subject claims.

As pointed out in the previous response, the U.S. Supreme Court in *Graham v. John Deere Co.*, 148 U.S.P.Q. 459 (1966) held that non-obviousness was determined under § 103 by (1) determining the scope and content of the prior art; (2) ascertaining the differences between the prior art and the claims at issue; (3) resolving the level of ordinary skill in the art; and, (4) inquiring as to any objective evidence of non-obviousness.

A. The present inventive subject matter

The process described in the present application results in production of a wax with properties that include low color from pale yellow to white, hardness (0.12 to 1.4 mm penetration depth), low odor and bland taste. The process for preparation of white wax from crude sugar cane wax extracted from the filter cake is unique. Previously, reported color which could be achieved by various processes for treating sugar cane wax from that source had been pale yellow. The present process also addresses the long term and temperature stability of the color of the wax, currently not addressed by known processes for treating sugar cane wax. With standing or heating for prolonged periods at temperatures close to the melting point of the wax, the wax will often darken in color. The color can vary from brown to a black color. Processes which have been previously used, for example bleaching techniques, are unsuitable for comestible use because of the non-food-grade reagents used. The present process also introduces a simple but unique method for further separating the color and polar lipid components of the wax. This is achieved through a pitch inducement, whereby heat treatment allows the color and the polar

lipid to react to form an insoluble component, which can be removed by solvent fractionation.

The process described and claimed in the present application is a combination of physical and reaction steps which removes impurities, such as color and polar lipids, providing a wax with low and most importantly stable color and narrower composition with a higher alcohol content, providing sharper melting point and hardness. These steps include:

- 1) fractionation of the wax using the variation in the crystallisation of the various components of the wax at a specific temperature and in a particular solvent, with a lower alcohol being found to be the most desirable solvent for use of the wax in a comestible;
- 2) auto-oxidation of the double bonds which are partially responsible for color (note that the color of the wax is from pigments and color precursors which may not be colored but will form color after appropriate reaction—for example, carotenoids are unsaturated compounds which when cleaved will form color irreversibly, amino acids can react with reducing sugars to give a browning effect known as the Maillard reaction) and termination of free radical formation; and the optional steps of:
- 3) heat treatment to induce color formation from color precursors and reaction of fatty acids and other wax components which include inorganic components to form polar lipids which forms the majority of the pitch fraction aiding in the fractionation of glycerol, phosphates, sugars and amino groups from the desired wax component; or

- 4) use of adsorbent to further remove additional color and other impurities responsible for color, odor and taste from the wax.

The combination of these steps for processing crude sugar cane wax was neither taught nor suggested by what was known before the invention was made and addresses not only the removal of impurities but also the storage and thermal stability of the wax, which are important for the many uses of the wax composition product of the process.

In summary, the process of the invention such as defined in claim 2 provides a wax composition having properties that include the following:

- a) low **stable** color;
- b) no odor or taste;
- c) improved hardness (comparable to carnauba wax); and
- d) suitability for use in foods.

These properties are referred to in the specification—see page 8, lines 4 to 16 of the description.

As pointed out in the previous response, claim 2 is an independent method claim drawn to a process for preparing a wax composition from crude sugar cane wax, the process comprising the steps of: heating a solution of the crude wax with a lower alcohol as solvent at the boiling point of the solvent; allowing phase separation of the solution from the above step and decanting the upper phase while hot; allowing the separated phase from the second step to cool and separating crystallised wax from the solvent; repeating the first three steps using the wax from the third step until all pitch has been removed from the wax; heating the wax to between 90 and 140°C and oxidizing molten wax with oxidizing material; and continuing the heating under an inert gas on

completion of the oxidation step until intermediate peroxide products are removed. Items (1) and (2) of the above summary of the invention embrace the steps recited in this claim.

The remaining claims depend from claim 2, or from another claim that depends from claim 2, and thus contain the limitations found in therein. Applicant reiterates that if claim 2 is found to be not obvious over the prior art references, then none of the claims are obvious over the references.

B. The prior art

Applicant summarized the cited prior art in the previous response. To further assist the Examiner, a more detailed analysis of each citation follows in which analysis the differences between a citation and the relevant process step of the claimed invention is pointed to.

The Fujisawa et al. citation (Derwent '284 abstract) relates to a process for the extraction of sugar cane wax using ethanol at pressure and a temperature above the boiling point of the wax. A preferred temperature is 120°C. The wax extracted is then decolorised by chemical oxidation with H₂O₂. Although there is similarity in terms of the use of solvent and an oxidation step, the processes according to the present application and Fujisawa et al. are different from the point of view of what each process achieves as the final material as will be outlined below.

i) The resulting wax derived from the two processes will be different.

The use of a high temperature such as 120°C with ethanol would improve the ability of this solvent to extract waxes. As the temperature is increased, so is the extraction of the higher molecular weight components of the wax. In the process according

to the present application, fractionation of the crude wax is conducted, for example, at the boiling point of ethanol and the wax, and would be about 78.5°C. The difference in the temperature of the two processes will result in a different wax product. The higher temperature used by Fujisawa et al. will produce wax with a composition closer to the crude wax used as a starting point in the process according to the present application.

ii) The Fujisawa et al. wax will not be applicable to food.

Fujisawa et al. does not address the removal of impurities, which can be extracted from the filter cake, making their wax unsuitable for use in food. These impurities include soluble inorganics such as phosphates, organics such as sugars, amino groups, and pigments. The process of the present application addresses the removal of these impurities through the process steps summarised above. Furthermore, the Fujisawa et al. process does not address the removal of residual peroxide, an oxidation product, which can have toxic effects and will contribute to possible oxidation of the other components of the wax. According to the present application, the problem is addressed, for example, by blowing nitrogen into the melt to remove this residual chemical and by the optional use of absorbent.

iii) The Fujisawa et al. process addresses only part of the problem of color of the wax and its stability.

Sugars and amino acids and other potential color precursors are not removed by the Fujisawa et al. process. The chemical oxidation step only addresses the presence of unsaturation present in certain color precursors such as carotenoids, as the source of color. It does not address the possible browning effect from the Maillard reaction resulting from amino groups and sugars present in the wax. Color precursors are also not removed by the Fujisawa et

al. process. These color precursors are removed in the process according to the present application by: 1) pitch inducement, or heat treatment, which promotes the reaction of the fatty acids with the amino groups and sugar and so on to form polar lipids; 2) solvent fractionation of the compound with the polar lipids or pitch; and 3) use of absorbent to remove residual pigments and other impurities.

iv) The Fujisawa et al. process does not address the problem of odor.

The oxidation step results in the formation of products, which have odor, as observed by the applicant. Haines et al. infer this too and suggest a saponification step to remove these products. The process according to the Application addresses this by two steps: 1) blowing non-oxygenated-gas to purge the odor from the wax; and, optionally, 2) by the use of an absorbent to remove compounds responsible for odor as well as residual color and taste.

The Arai et al. disclosure (Derwent '289 abstract) is a process that refines crude sugar cane wax by heating the crude wax in a lower alcohol and allowing the wax to precipitate on cooling. The precipitated wax is removed by a solid-liquid separation process. Residual solvent is removed by distillation. High density absorbents are also added to remove pigments and to neutralize acidic matter. The differences between this process and Applicant's process are outlined below:

i) The wax processed by Arai et al. is different to Applicant's wax. In the Arai et al. process the wax extracted will contain the hard wax and pitch. In Applicant's process, the pitch is separated as an insoluble component in the hot solvent.

ii) The wax of the Arai et al. process will not be suitable for use in food as it will contain a number of organic and

inorganic impurities. These impurities include phosphates and other chemicals present during the processing of sugar. Such impurities are separated from the wax as part of the pitch in Applicant's process.

iii) Arai et al. does not address the thermal and storage stability of the wax. Although color is removed from the wax by the use of absorbents, it does not improve the oxidation stability of the wax. The wax will contain certain compounds, in particular fatty acids, which will be susceptible to oxidation. Formation of oxidized compounds therefrom results in foul odor, taste and further degradation of the wax. Applicant addresses this problem by partial oxidation of the wax to allow these species to oxidize, followed by removal of the oxidized species by blowing inert gas through the wax. Residual contaminants can optionally be removed through the use of absorbent, as pointed out above.

The Whyte et al. disclosure is a process for treating hard wax (or deresinated crude sugar cane wax) by mixing with rosin adducts, rosin esters and mixtures of these and oxidizing with oxygen-containing gas at a temperature of from 80 to 155°C. Whyte et al. suggest that the addition of rosin acids and adducts, normally extracted from tall oil, followed by oxidation, results in a wax with less color and odor. Rosin acids and esters are unsaturated compounds. In the Whyte et al. process, the color of the wax is addressed by oxidation of unsaturated compounds contributing to color. However, as pointed out above, to fully address improvement of the color of the wax, the process must take into consideration both the unsaturated compounds and other color precursors such as amino acids and reducing sugars which with heating and storage will gradually cause browning. Applicant's process addresses this through steps including pitch inducement, solvent fractionation,

auto-oxidation and use of absorbent. Furthermore, the Whyte et al. process does not teach removal of the oxidation products. Although Whyte et al. indicate that the final wax has no odor, Applicant has found that it is necessary to remove the oxidation products. Applicant has found that blowing inert gas into the melt to reduce the peroxide level is more effective than continuing to use gas that contains oxygen. This is because oxygen will continue to oxidize the wax that will continue to form the oxidation products that the process is attempting to remove. Furthermore, Applicant has found that an absorbent is required to mop up the last traces of oxidized color compounds and residual chemicals.

The Rieger et al. disclosure is a process for converting natural waxes suitable for carbon paper. This is conducted by oxidation of the natural wax at temperatures from its melting point to 250°C, with oxygen-containing gases in the presence of catalyst. Pre-treatment with solvent, heat, oxidative bleaching, esterification, saponification and amidation may be applied. However, these pre-treatments are not necessary for the properties required of the wax. The Examiner has also cited Haines et al. who describe a similar process of oxidation with oxygen-containing gas in the presence of catalyst. Haines et al. refer to the application of the process to microcrystalline wax while Rieger et al. apply their process to natural wax, including sugar cane wax. The purpose of the oxidation reaction in these processes is different to its purpose in Applicant's process. In these two processes, oxidation is used to reduce the degree of unsaturation of all compounds, which unsaturation reduces the hardness of the wax. The reaction is carried out until sufficient hardness is achieved. This hardness is a required property of the wax for application in inks and printing.

In the process according to the present application, controlled oxidation is carried out to render colored precursors or compounds with unsaturation colorless (e.g., carotenoids) preferentially. Severe oxidation can often cleave these compounds resulting in the formation of more colored compounds that cannot be reversed. Leaving them untreated will make the wax sensitive to gradual oxidation with storage and when heated, resulting in dark brown or black colored wax which can make them unsuitable for use in food. Controlled oxidation is required to achieve the decolorization. The Rieger et al. process demonstrates the result of excessive oxidation of the wax by the formation of black wax after processing (see, for example, column 4 at lines 54 to 60 where there is reference to the wax obtained by the process of the invention having a "darker color" and the table in Example 3 at column 6 where the color of the final product is given as "black"). This clearly demonstrates that this form of oxidation achieves the opposite effect to that sought by Applicant in the oxidation step which is decolorization and stability of the wax color with storage and heating. Haines et al. do not describe the effect of oxidation on the color of the wax. Their microcrystalline wax starting material, normally extracted from petroleum, will most likely not contain the precursors found in natural waxes. In both processes, the resulting wax cannot be used in comestibles. The reasons include the type of non-food grade chemicals used and the process does not address the removal of other impurities such as inorganics and fertilisers that can be present in the crude wax. The processes also do not remove the oxidation products such as peroxides, which clearly has increased in the Rieger et al. wax product (see the table in Example 3 at column 6 where the peroxide number is 16 in the starting material but 20 in the final product).

The Shimizu et al. (Derwent '288 abstract) process concerns the extraction of sugar cane wax from the rind of the sugar cane using heptane at its boiling point. The solvent is distilled to produce a yellow wax. The differences between Shimizu et al. and Applicant's process are as follows:

i) The wax extracted will be different. Waxes found on the outer rind are different to the wax found within the cane plant. Similarly, the different solvent—heptane not being a lower alcohol—will also result in a wax of different composition.

ii) The Shimizu et al. wax will not have thermal or storage stability. In the Miyagi et al. patent cited by the Examiner in Paper No. 6, there is reference to the extraction of pigment and salt impurities from cane molasses into organic solvents. In the Miyagi et al. process, the pigments are removed by changing the alkalinity of the solvent and the salt by changing the polarity of the ethanol solvent through addition of water. The Shimizu et al. process does not address the removal of these impurities. Fujisawa et al. mention the problem with color which is addressed by auto-oxidation of double bonds of the compounds responsible for the problem. The Shimizu et al. process does not address this potential problem. Furthermore, since the oil fraction—which contains a high quantity of tri-glyceride—is not removed, the wax will be susceptible to oxidation and will degrade quickly with storage and when heated. Tri-glycerides when oxidized will be cleaved to form fatty acids and oxidized compounds that can contribute to foul taste and odor. Lipid hydroperoxides, a by-product of the oxidation of triglyceride, can further oxidize other wax components, resulting in the alteration of the wax composition and properties. Applicant's process addresses the removal of impurities through incorporation in the process of the invention

the steps summarized above.

As noted above, the Haines et al. disclosure is a process for preparing hard wax from microcrystalline wax. According to this process, oxidation is used to remove unsaturation to produce hard wax. This is conducted on the molten wax at temperatures between 115 to 165oC in the presence of catalyst. Hardness is improved further by melting the wax in an organic solvent, methyl ethyl ketone and toluene, cooling to precipitate the hard wax and filtering to separate the soluble or oil fraction dissolved in the solvent from the hard wax. Saponification is used to remove residual oxidation products such as fatty acids and esters, considered to be responsible for odor in the wax. The mixture is washed with water to remove the soap. The water is removed from the wax using acetone finally azeotropic distillation with benzene. Residual benzene is removed by bubbling nitrogen into the molten wax. Differences between the application of an oxidation step in this process and an oxidation step in the process of the present invention are given above in the comments on the Rieger et al. patent.

The process described in the Noda Wax patent (Derwent '299 abstract) is based on refining a crude wax. The crude wax is dissolved in an organic solvent and treated with an adsorbent to remove impurities. This process is somewhat similar to the process proposed by Arai et al. in that wax impurities and color are also addressed with the use of an adsorbent. The Noda Wax process however is applied directly to the crude wax without solvent fractionation to separate the pitch or the oil fraction.

Applicant removes impurities by the steps described above. This separation enables large quantities of color and impurities to be separated from the crude wax. The advantage of this is that at

this stage no wax is actually lost, as the fractions are simply separated. However, color and inorganic impurities are removed. The next stage that is also not implemented by Noda Wax is the oxidation of unsaturated color precursors. Finally, residual color that is visible can be removed by the use of adsorbent. Since the residual impurities are low, and most have been removed by the previous steps, the adsorbent can be used efficiently. Application of the adsorbent to the crude wax, as in the Noda Wax process, will result in the use of significant quantities of adsorbent that will also result in large losses of wax into the adsorbent. Whyte et al. indicate that in crude wax which is not properly deresinated, the black resin impairs color change. Applicant has also found in its tests that it is difficult to remove color from the resin using adsorbent. This indicates that significant quantities of adsorbent must be used to remove color. The more adsorbent used the higher the losses of the wax into the adsorbent, which can often be difficult to recover. The process according to the claims of the present application involves a series of steps which allows the removal of impurities without the use of adsorbent. The use of adsorbent is a mopping-up step to remove residual impurities. Consequently, the process according to Applicant's invention avoids significant loss of wax and allows a more efficient use of the adsorbent.

Pitch is the component of the wax that does not dissolve in lower alcohol solvents. As such it is likely that the pitch will be separated with the adsorbent. This will leave a waste consisting of adsorbent and pitch. Separation of these materials will be difficult because of the low solubility of the pitch. Recovery of the adsorbent will therefore be low. Subsequent use of the pitch must then comprise a use of the pitch/adsorbent mixture.

Applicant's process avoids this situation by the initial fractionation of the pitch from the crude wax.

The process applied by Noda Wax will have an oil fraction, which will result in a softer wax. In contradistinction, Applicant's process concentrates on the hard wax fraction of the crude wax. The oil fraction, like any soft fats and oils, contains a high fraction of triglyceride (~50%) which is undesirable. Triglyceride can be oxidized and will be cleaved to form fatty acid and other oxidation products, which forms rancid odor and taste. Furthermore, lipid hydroperoxide products can induce the oxidation of other components in the wax, which can gradually change its composition with storage and during processing. As such, if the oil fraction from the wax is not removed, it will make the final wax according to the Noda Wax process more susceptible to oxidation and can contribute to poor storage stability of the wax. The hard wax, which is the component processed by Applicant, contains negligible quantities of triglyceride.

In addition, Applicant's process with its oxidation step, will allow components of the wax which are susceptible to oxidation to be oxidized resulting in products that are undesirable but can be removed by the subsequent steps of the process. For example color, peroxide products and odor are removed by blowing inert gas through the wax and the optional final use of the adsorbent. Since oxidation-sensitive components have been oxidized, it is less likely that the compounds will react during storage and or processing of the wax which can severely alter its composition and properties. As such, the Applicant's process clearly addresses the issue of the storage and thermal stability of the wax.

The McCloud patent does disclose the heating of crude sugar cane wax in a lower alcohol. However, although the process is

described as the refining of sugar cane wax, all that the process achieves is removal of the resinous fraction. This is clear, for example, from column 1, lines 22 to 24 where the inventor states that he has "developed a process for removing the resinous fraction from the hard wax fraction".

The emphasis of the McCloud patent is extraction of wax. Hence, the process can be carried out at a temperature much higher than the boiling point of the solvent with a liquid state of the solvent maintained through pressurization (see column 3, lines 1 to 4). Any steps of the process of the present invention that require heating in a solvent are carried out at the boiling point of the solvent.

The Wilder et al. disclosure is a process for fractionation of crude wax, in which the crude wax is boiled in isopropanol. The pitch that remains insoluble at this temperature is separated out by filtering the hot solvent and dissolved wax. The wax that is removed with the filtrate consists of the hard wax and oil fraction. This process in no way represents the series of steps of the Applicant's process. It merely addresses the necessary step of removing pitch from the crude wax. However, the Wilder et al. process does not address the additional physical and chemical treatments required to remove color precursors with unsaturation that are sensitive to oxidation and to remove amino acids, reducing sugars and phosphates. In addition, the process does not address how to remove residual oxidation products such as peroxides and oxidized color compounds, odor and taste by the process steps taught by the Applicant.

**C. The Differences Between the Claimed Subject Matter
and the Prior Art**

The differences between the prior art relied on by the

Examiner and the process as claimed can be summarised as follows:

a) None of the prior art processes cited by the Examiner provide the exact combination of physical and chemical steps to address the color, inorganic impurities and thermal and storage stability of the refined sugar cane wax as set forth in the claims of the present application.

b) The prior art processes cited by the Examiner, for example the oxidation reaction of the wax, have been applied for different purposes. Oxidation of unsaturated compounds can lead to the formation of harder wax, the process being similar to the hydrogenation of oil to form margarine. The auto-oxidation as applied by Applicant targets the decolorization of unsaturated color precursors.

c) None of the prior art processes cited by the Examiner address the removal of all the specific impurities which must be removed to enable the use of sugar cane wax for food applications, as addressed by Applicant's process. These include impurities already present in the filter mud which are subsequently transferred into the organic solvent such as inorganics from dirt from the cane plant and residual chemicals from fertilisers or those used in processing of the milled sugar. Miyagi et al. teach removal of salts by changing the polarity of ethanol to precipitate the salts. The present process addresses this by: 1) pitch inducement; 2) solvent fractionation; and, 3) use of adsorbent. This is a thorough series of techniques, which addresses both insoluble and soluble inorganic and inorganic-organic compounds. Miyagi et al. address only the insoluble components. Impurities are also present, which results from the processing. Oxidation results in the formation of odorous compounds. Haines et al. address this through saponification. Auto-oxidation will have

residual peroxide products. None of the cited prior art addresses the removal of residual peroxide. In fact, Rieger et al. quotes an increase in the peroxide level of the final wax compared to the starting wax in Examples 1 and 3. Applicant's process addresses these impurities by blowing non-oxygenated gas to drive the odor and residual peroxide from the melt. An adsorbent is also used to remove residual odor compound that is not completely removed by the previous step. Again, these steps provide a thorough combination of steps that ensure the efficient removal of the impurities. The oil fraction of the wax is also removed to reduce the fatty acid groups in the wax. The fatty acids are susceptible to oxidation to form ketones and aldehydes, which can have undesirable properties for comestible use.

d) None of the prior art processes cited by the Examiner address all the sources of color, as addressed by Applicant's process. Color can result from the presence of pigments (visible color) and color precursors. The cited prior art addresses only the pigments and unsaturation. These are removed by use of adsorbents and auto-oxidation of these compounds. Color also forms as a result of the presence of other impurities, which include amino acids, nitrogen-containing compounds, sugar and other color precursors. As noted above, these compounds react through the Maillard reaction to create a browning effect. None of the cited prior art cited by the Examiner addresses the removal of these compounds. Applicant's process utilizes pitch inducement and solvent fractionation to remove these impurities. Pitch unexpectedly was found to form with heat treatment of the wax. Fatty acid groups are found to react with amino groups, sugar and phosphates to form polar lipids, which essentially makes up the pitch. Subsequent solvent fractionation allows the removal of the

pitch, which is insoluble in the solvent at its boiling point. The optional further use of adsorbent further removes these impurities. The process removes not only the impurities but also reduces fatty acids in the wax.

f) None of the prior art processes cited by the Examiner produces comestible wax from crude wax, which has the thermal and storage stability addressed by the applicant's process. None of the citations teach the step of pitch inducement or heat treatment followed by solvent fractionation as an additional means of removing color and other impurities from the wax. Pitch inducement promotes the reaction of fatty acids with amino groups, reducing sugars, phosphates to form polar lipids and in addition formation of color. Subsequent fractionation with a solvent allows the separation of these impurities from the wax.

g) The three clear steps that can be derived from the cited prior art include solvent fractionation, oxidation and use of adsorbent. From the cited art, none of these three have been combined to form a process. Even if all three are combined, it still does not include the use of pitch inducement, as used in Applicant's process, which is not taught by any of the cited art. The objective of Applicant's process, which is the production of wax from crude wax which can have comestible application with thermal and storage stability, cannot be achieved by any of the processes cited, as discussed above. The stability of the material is important to ensure the composition and its food grade status is maintained. None of the processes clearly address all the issues addressed Applicant's process.

**D. Comments Relevant to the Rejection
of Specific Claims**

In commenting on the Examiner's rejection of claims 2 and 3, it was noted in the response to Paper No. 3 that the Examiner relies on the Derwent '284 abstract to attempt to teach the first three steps of the inventive subject matter of claim 2 and the method as defined in claim 3 where the lower alcohol used is ethanol. The Examiner admits on the record that the Derwent '284 abstract does not teach "repeating the steps of heating, phase separation, and cooling to crystallize wax, and the ['284] reference is silent in teaching further oxidizing the molten wax (at 90°C to 140°C) and removing any resulting peroxide products." The Examiner looks to other prior art references to provide these steps.

Applicant respectfully submits that a full explanation as to why the Derwent '284 abstract does not specifically disclose or teach steps (i) to (iii) of the process according to the subject claims, and why the additional prior art references do not specifically disclose the additional steps of these claims, was given in the previous response. Nevertheless, in view of the more detailed analysis of the cited prior art given above, Applicant will provide further comment on why the art relied on by the Examiner does not provide the steps set forth in the rejected claims. Applicant will furthermore show below that even if the steps according to the combined citations were followed, the composition according to the process of claims 2 and 3 would not be provided.

The Examiner asserts that the Derwent '289 abstract "teaches the conventionality of repeating the steps of heating, phase separation to isolate the crystallize [sic] wax (noted as Process

I and Process II). Processes I and II are in fact different processes. In Process I, a 3-30 fold amount of solvent is added along with an insoluble high-density material. In Process II, a 3-20 fold amount of solvent is used and there is no addition of an insoluble high-density material. Process II is not, therefore, a repetition of Process I. Process II is followed by Process III which is the step of removing the solvent from the wax solution of Process II.

There is absolutely no suggestion in the Derwent '289 abstract of the repetition of either of Processes I and II. The process disclosed in the Derwent '289 abstract is thus limited solely to the execution of Process I, followed by Process II, followed by Process III. Contrary to the Examiner's assertion, therefore, the Derwent '289 abstract does not teach the conventionality of repeating steps (I) to (iii) of claim 2.

The Examiner next relies on Whyte et al. as evidence of the conventionality of heating refined sugar cane wax with oxidizing material to eliminate color and odor. As noted above, there is indeed a heating and oxidation step disclosed by Whyte et al. But as also noted above, a crucial feature of the process according to the present application is the removal of peroxide formed during the oxidation step. There is no hint or suggestion of peroxide removal in the Whyte et al. patent.

The Examiner relies on Rieger et al. as further evidence of heating a sugar cane wax after treating with a solvent, and oxidising the wax with an oxidizing material to eliminate odor with air or any oxygen liberating gas used as the oxidizing material. The Examiner additionally points to Rieger et al. as a teaching of the gas current being an oxidizing agent or an inert gas "to remove substances to improve wax quality". Again, the crucial

consideration is whether teaches the removal of peroxides formed during the oxidation process. The specific passage of relevance to this issue as cited by the Examiner reads (in part) as follows:

"The quality improvement is, however, not the result of the blowing out alone. This is clearly proven by the fact that a noticeable improvement in the wax quality cannot be obtained by blowing through nitrogen or hydrogen instead of oxygen-containing gases. [column 4, lines 5-10]"

It is clear from this passage that Rieger et al. tested nitrogen or hydrogen as an alternative to an oxygen-containing gas. This is consistent with the statement earlier in column 4 that the purpose of the blow through gas was to remove "volatile and condensable substances" from the reaction mixture (see column 4, lines 1-5). It cannot be read into this passage that Rieger et al. intended blowing through with nitrogen or hydrogen for the removal of peroxides.

Contrary to the Examiner's assertion, Rieger et al. does not provide support for it being conventional in the art to use an inert gas for the removal of peroxides formed during an oxidation step. Indeed, as pointed out above, peroxides actually increased in one application of the process according to Rieger et al. (see Example 3 at column 6). Additionally, a feature of the process according to claim 2 of the present application is that heating is continued during the inert gas treatment. There is no hint or suggestion of this in the Rieger et al. patent.

For at least the following reasons, the prior art relied on by the Examiner does not render the subject matter of claims 2 and 3 of the present application obvious and unpatentable because:

i) there is no teaching in the cited art of the repetition of the first three steps of claim 2; and

ii) there is no teaching of the use of an inert gas for the removal of peroxides following the oxidation carried out in step (v).

As urged in the response to Paper No. 3, with respect to the rejection of claims 3 to 16, since claim 2 defines non-obvious subject matter, the first mentioned claims, as dependent claims, must also be non-obvious.

Applicant mentioned above that that even if the steps according to the combined citations were followed, the composition according to the process of claims 2 and 3 would not be provided. This situation arises from the differences between the claimed subject matter and the prior art as set out above in section C.

Firstly, following the teachings of the Derwent '284 abstract would result in the initial steps of the process providing a wax having properties more like the crude wax starting material rather than the product of step (iv) of claim 2 which is a wax that is free of pitch. Using a wax preparation that still contains pitch would prevent production of a final product of the process having better than a pale yellow color, a sweet smell and little or no taste. Following the Derwent '289 abstract. Would similarly result in a different starting material to that actually used in the process according to the invention.

Secondly and as pointed out above, following the teachings of the Whyte et al. and Rieger et al. patents would result in a composition that would not have stable color. In fact, following these teachings would result in a composition with deeper color. This is because the application of the process steps taught in these patents would not eliminate the color-forming contaminants in the wax.

With regard to additional prior art relied on by the Examiner,

a skilled person who followed the teachings of the Derwent '288 abstract would again not obtain the wax composition according to the present claims. Thus, introduction of this teaching into the process as defined in claims which are antecedents of claims 6 and 7 would still not overcome the deficiencies of the other citations.

Applicant reiterates a point made in the response to Paper No. 3 that a person of ordinary skill in the art would not be motivated to consider the teachings of prior art relied on by the Examiner as that prior art is not relevant to the problem addressed by the present invention. Specifically, the person of ordinary skill would treat as not relevant the following citations for the reasons given:

- the Derwent '284 and '289 abstracts because the subject waxes would not be suitable for use in comestibles;
- the Whyte et al. patent because it relates to a wax for use as a component of floor wax;
- the Rieger et al. patent because it relates to a wax for use in carbon paper;
- the Haines et al. patent because it relates to a procedure for the preparation of hard wax from microcrystalline wax;
- the Derwent '288 abstract because it relates to a wax from the outer rind of the sugar cane plant and not the more conventional sugar cane crude wax;
- the Noda Wax patent because, as explained above, its teaching would result in the inappropriate excessive use of absorbent in the context of the process according to the present claims.

Applicant notes that the Examiner relies on patent documents as evidence of what is conventional in the art. In most instances, the Examiner's reliance on these documents is in respect of features the subject of what is claimed. Applicant submits that a

recitation constituting an essential feature of a claim cannot be taken as an indicator of what is conventional in the art. Claiming of a feature requires that the subject matter being other than conventional.

2. REJECTION OF CLAIM 1 UNDER 35 U.S.C. §103(a)

The Examiner has rejected claim 1 under 35 U.S.C. §103(a) as being unpatentable over Synosky et al., Miguel-Colombel et al. (US 5882657) and Lake (US 3931258). This rejection is rendered moot by the cancellation of the rejected claim.

The replacement for claim 1, claim 18, is limited to a composition which is a product of the process defined in claim 2. Applicant submits that it has shown above that claim 2 is non-obvious. As the product of a non-obvious process, the composition of claim 18 must also be non-obvious.

3. REJECTION OF CLAIM 17 UNDER 35 U.S.C. §103(a)

The rejection under 35 U.S.C. §103(a) of claim 17 in Paper No. 3 still stands. The rejection is that the claim is unpatentable over Synosky et al. in view of Grimm, III.

By virtue of the amendment made to claim 17, the claim is now limited to a comestible that includes a composition that is the product of the claimed process. Accordingly, for the reasons given above in connection with new claim 18, Applicant submits that amended claim 17 is similarly non-obvious and as such defines patentable subject matter.

CONCLUSION

In view of the foregoing, applicant respectfully requests the Examiner to reconsider and withdraw the rejection of the claims and

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to allow all of the claims pending in this application.

If the Examiner has any questions or wishes to discuss this matter, the Examiner is welcomed to telephone the undersigned attorney.

Respectfully submitted,

NATH & ASSOCIATES

Date: October 11, 2001

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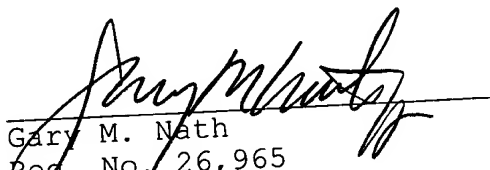
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In re Application of

Marjorie Gan VALIX

Serial No.: 09/402,362

Filed: October 4, 1999

For: **FOOD GRADE WAX AND PROCESS FOR PREPARING SAME**

ATTACHMENT A - MARKED-UP COPY OF CLAIM AMENDMENTS

Please cancel claim 1 without prejudice or disclaimer to the subject matter contained therein.

Please amend claims 2 and 17 as follows.

2. (Amended) A process for preparing a food grade wax composition from crude sugar cane wax, the process comprising the steps of:

i) heating a solution of the crude wax with a lower alcohol as solvent at the boiling point of the solvent;

ii) allowing phase separation of the solution from (i) and decanting the upper phase while hot;

iii) allowing the separated upper phase from (ii) to cool and separating crystallised wax from the solvent;

iv) repeating steps (i) to (iii) using the wax from (iii) until all pitch has been removed from the wax;

v) heating the wax to between 90 and 140°C and oxidising molten wax with oxidising material; and

vi) continuing the heating under an inert gas on completion of the oxidation step until intermediate peroxide products are removed.

17. (Amended) A comestible which includes the food grade wax composition of claim [1] 18.

Please add the following new claim 18:

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18. A food grade wax composition product of the process according to claim 2, wherein said composition comprises on a weight basis: wax esters, 6.2-11%; aldehydes, 2.8-9.5%; tri-glycerides, 0-3%; alcohols, 1.8-44.5%; and, free fatty acids, sterols and polar lipids, 36.8-87.2%.

β³

In re Application of

Marjorie Gan VALIX

Art Unit: 1761

Serial No.: 09/402,362

Examiner: R. Madsen

Filed: October 4, 1999

For:

FOOD GRADE WAX AND PROCESS FOR PREPARING SAME

ATTACHMENT B - CLEAN COPY OF CLAIM AMENDMENTS

Please cancel claim 1 without prejudice or disclaimer to the subject matter contained therein.

Please amend claims 2 and 17 as follows.

2. (Amended) A process for preparing a food grade wax composition from crude sugar cane wax, the process comprising the steps of:

i) heating a solution of the crude wax with a lower alcohol as solvent at the boiling point of the solvent;

ii) allowing phase separation of the solution from (i) and decanting the upper phase while hot; ← Figure.

iii) allowing the separated upper phase from (ii) to cool and separating crystallised wax from the solvent;

iv) repeating steps (i) to (iii) using the wax from (iii) until all pitch has been removed from the wax;

v) heating the wax to between 90 and 140°C and oxidising molten wax with oxidising material; and

vi) continuing the heating under an inert gas on completion of the oxidation step until intermediate peroxide products are removed.

17. (Amended) A comestible which includes the food grade wax composition of claim 18.

Please add the following new claim 18:



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